Cedar River Gravel Study
Phase 2 Report

prepared by
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with
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for
U.S. Army Corps of Engineers
Seattle District
and
Jones & Stokes, Inc.

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Study Purpose

Does the Cedar River have a "gravel problem"?

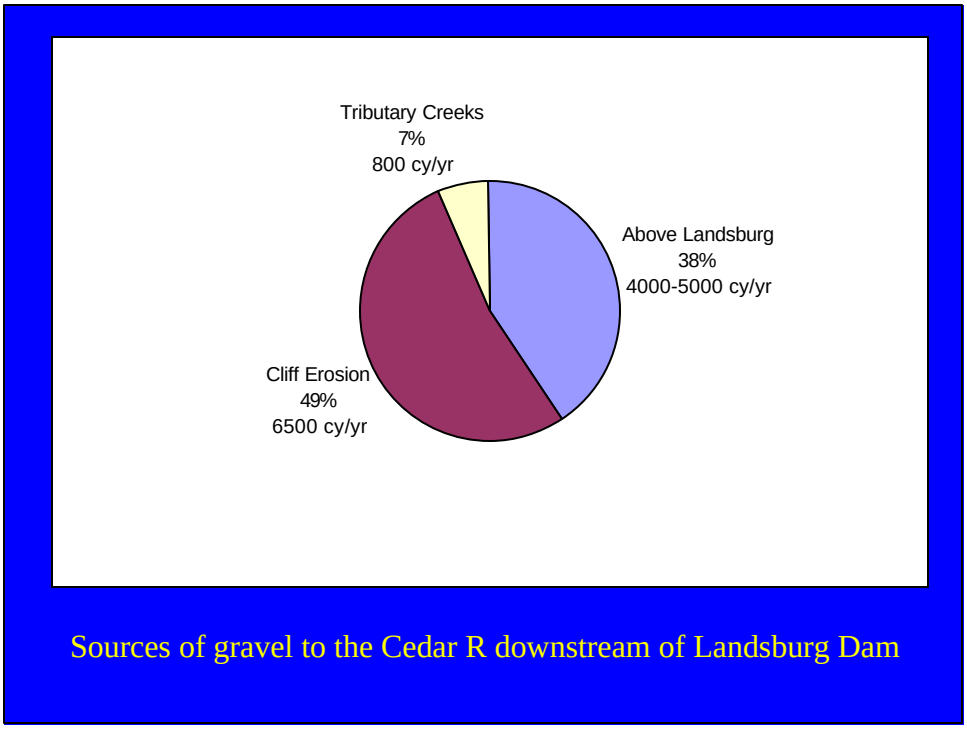
- **Assess the quality and distribution of spawning size gravels**
    - **with respect to hydraulics**
    - **with respect to sediment supply**
- **Determine cause of lack of gravel in certain reaches**
    - **naturally occurring factors**
    - **human changes to the river morphology**

Phase 1 Gravel Study -- Jones and Stokes

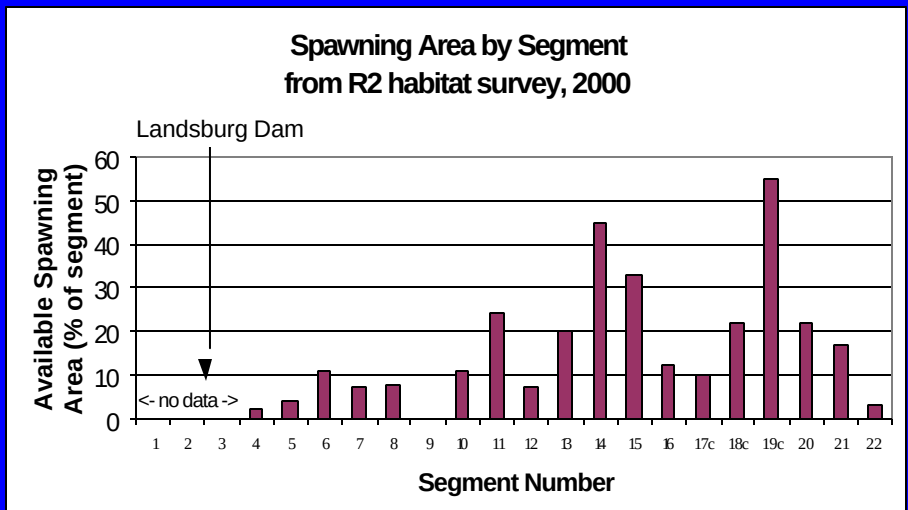
- **22 segments based on gradient and confinement**
- **pebble counts, channel geometry and habitat data at 32 sites with flood-study cross sections**
- **collect and review data from other studies**

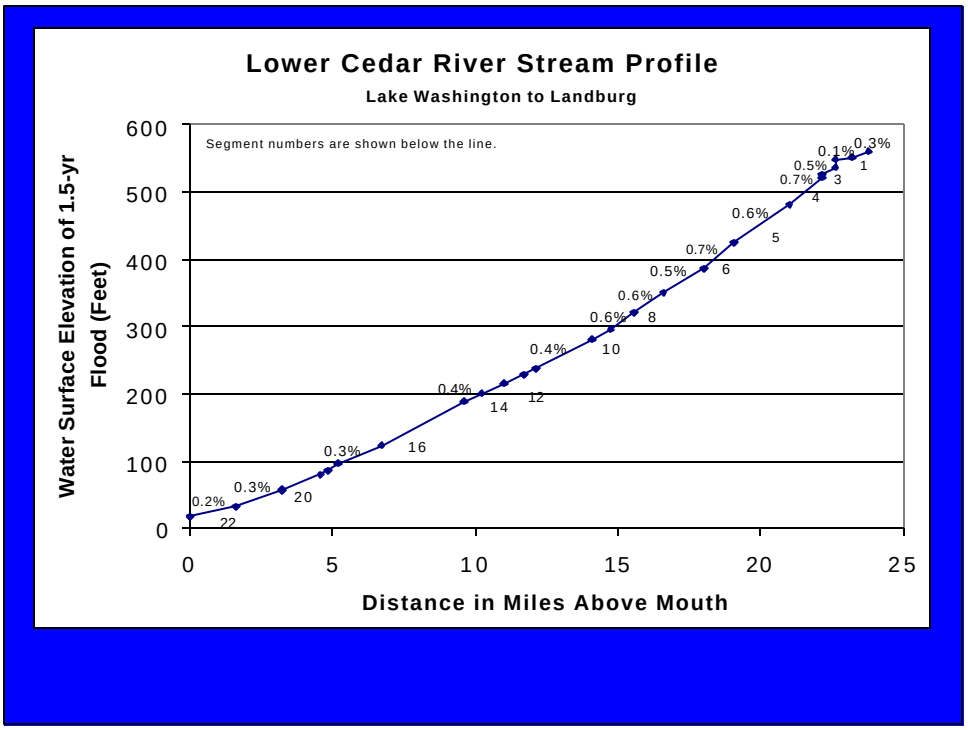
Phase 2 Gravel Study

- **construct sediment budget**
- **hydraulic analysis (HEC-RAS)**
  - **flooded width, bed shear stress, gradient**
  - **cross sections and reach-average values**
- **identify relationships between available spawning area, hydraulic variables, and morphologic variables**



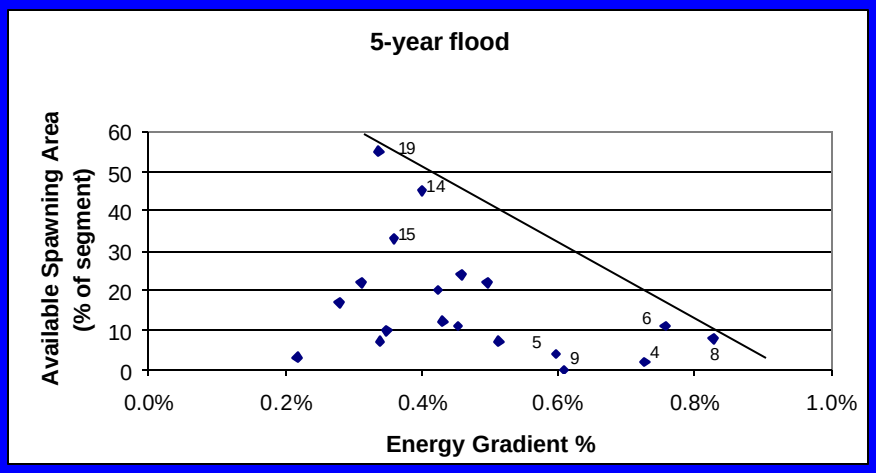
Sources of gravel to the Cedar R downstream of Landsburg Dam


Spawning Area by Segment
from R2 habitat survey, 2000
Landsburg Dam
Available Spawning Area (% of segment)
60
50
40
30
20
10
0
<- no data ->
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17c 18c 19c 20 21 22
Segment Number

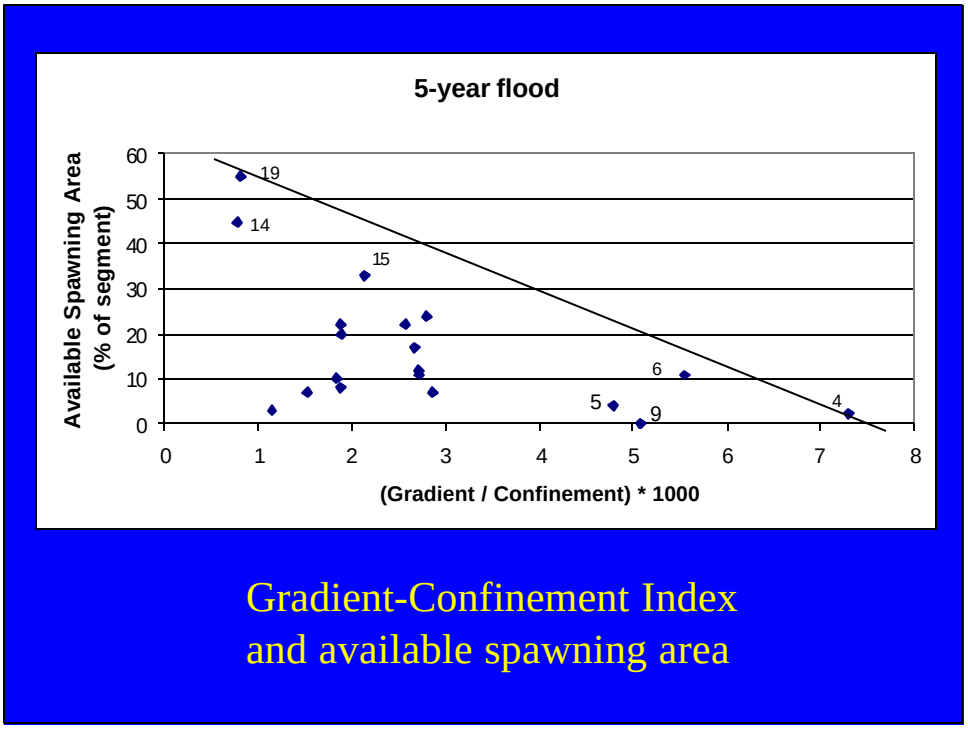

Lower Cedar River Stream Profile
Lake Washington to Landburg
Segment numbers are shown below the line.
Water Surface Elevation of 1.5-yr Flood (Feet)
600
500
400
300
200
100
0
0
5
10
15
20
25
Distance in Miles Above Mouth
0.3%
1
0.1%
0.5%
3
0.7%
4
0.6%
5
0.7%
6
0.5%
8
0.6%
10
0.6%
12
0.4%
14
0.4%
16
0.3%
20
0.3%
22
0.2%

Effect of Landsburg Diversion Dam on Gravel Transport

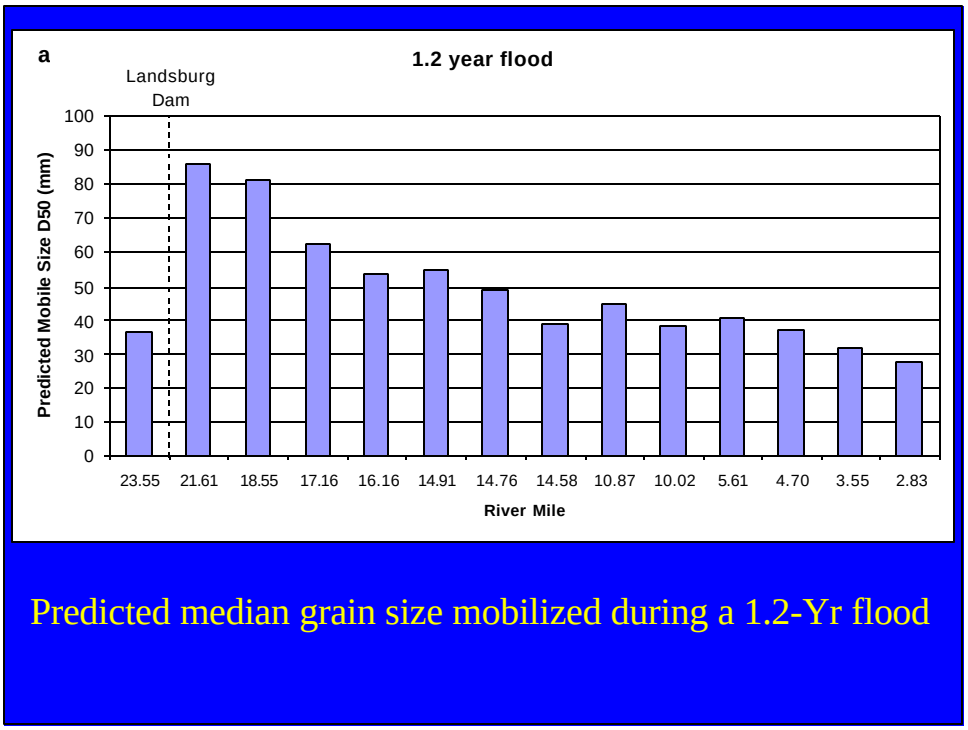
- dam gates are open during flows large enough to transport gravel
- no evidence of sediment deposition above dam
- lack of gravel in steep downstream reaches is explained by geomorphology and hydraulics



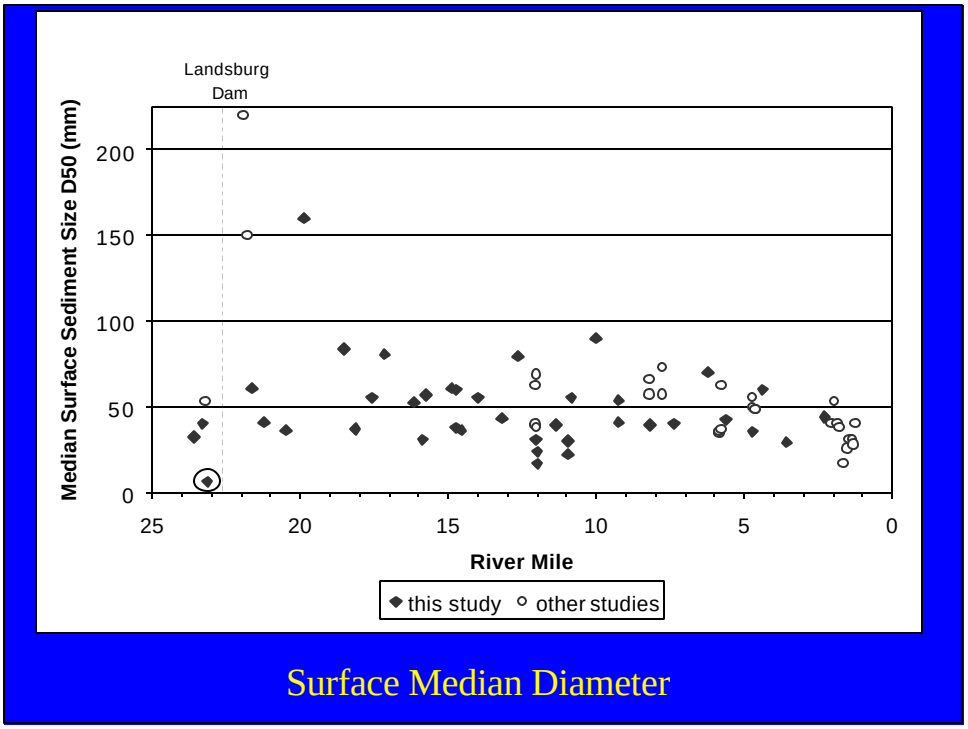
Gradient and available spawning area



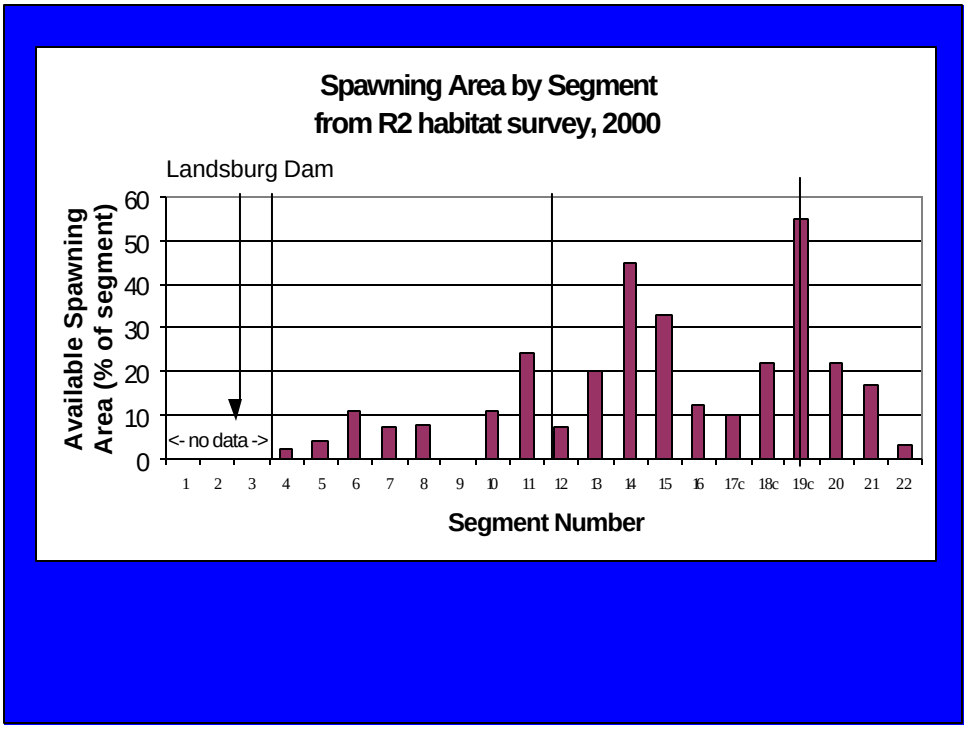
Gradient-Confinement Index and available spawning area



Predicted median grain size mobilized during a 1.2-Yr flood



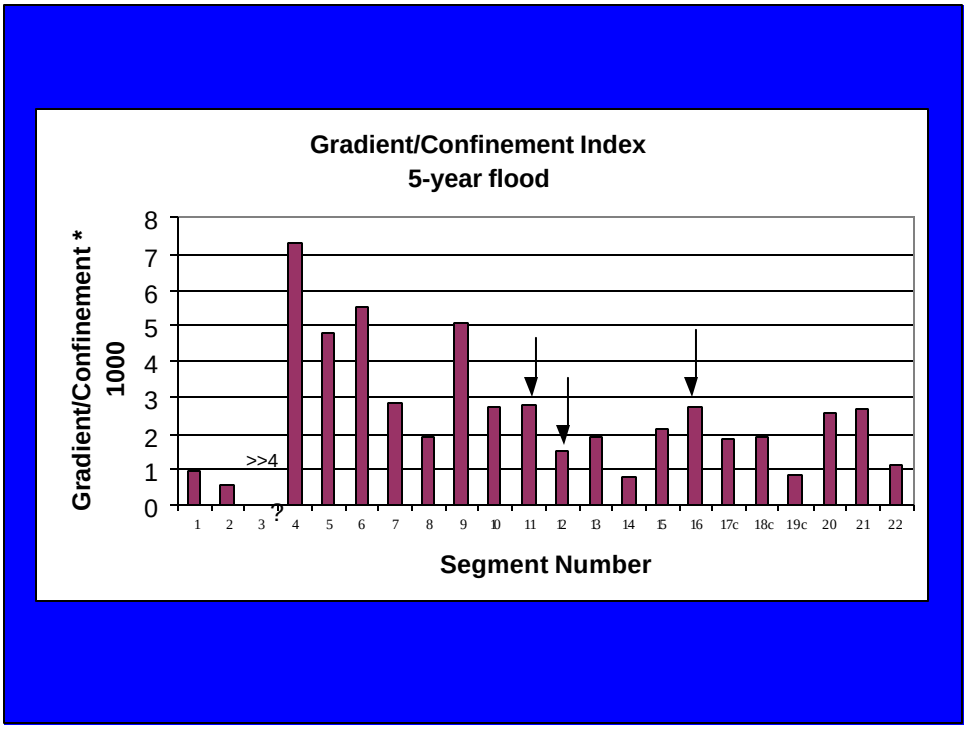
Surface Median Diameter



Recommended Restoration Strategies Related to Gravels

Restore floodplain connection to promote gravel deposition and sediment exchange between bed and banks

- **Levee removal or setback**
- **Floodplain Excavation**


Gradient/Confinement Index
5-year flood
Gradient/Confinement * 1000
0
1
2
3
4
5
6
7
8
>>4
?
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17c
18c
19c
20
21
22
Segment Number

Restoration Strategies of Limited Usefulness

- gravel augmentation
- control of fine sediment sources
- artificial spawning channels